HENSLOW'S SPARROW STATUS IN NEBRASKA AND A PRELIMINARY SURVEY OF SOUTHEAST NEBRASKA GRASSLAND HABITAT

Henslow's Sparrow habitat: Pawnee Prairie WMA, Pawnee County, Nebraska (Photo by Ross Silcock)
Inset: Juvenile Henslow's Sparrow (photo Powdermill Avian Research Center, used with permission)

W. Ross Silcock
P.O. Box 57
Tabor, IA 51653
silcock@rosssilcock.com

Joel G. Jorgensen
Nebraska Game and Parks Commission
Lincoln, NE 68503
joel.jorgensen@ngpc.ne.gov

Recommended citation

Silcock, W.R., and J.G. Jorgensen. 2006. Henslow Sparrow status in Nebraska and a preliminary survey of southeast Nebraska grassland habitat. Report of the Nebraska Game and Parks Commission Nongame Bird Program, Lincoln, NE.

SUMMARY

The Henslow's Sparrow (*Ammodramus henslowii*) is arguably the most-imperiled grassland bird species in eastern North America. It is both a Partners in Flight species of "highest concern" and a Nebraska Natural Legacy Plan Tier I, "at risk", species. Henslow's Sparrow currently occurs regularly during the breeding season at fewer than 10 sites in Nebraska. Numbers may have increased in Nebraska since 1990, however. This may partially be a result of enrollment and maturation of CRP grasslands.

In 2006, Henslow's Sparrows were found at only five sites out of 279 that totaled 29,500 ha during surveys in southeast Nebraska. While some Henslow's Sparrows were certainly not detected because of survey limitations, it is apparent that the species is neither common nor widespread in southeast Nebraska. The relatively small number of fields possessing apparently suitable habitat is likely the primary factor limiting numbers in this area. Grazed pastures and CRP fields planted to or reverted to European Smooth Brome do not provide suitable habitat for Henslow's Sparrows

Henslow's Sparrows require relatively large (preferably > 25 hectares) prairie tracts that have a well-developed litter layer and standing residual vegetation. Furthermore, grasslands that are invaded by woody vegetation are generally not used by the species. Thus, intervention is necessary for maintenance of optimal breeding habitat for Henslow's Sparrow, usually some type of natural disturbance. Burning may be the most effective and cheapest technique for Henslow's Sparrow, and should be used each year on a rotating portion, one-third or less, of a managed grassland unit. Rotational disturbance, preferably burning, fits well with the rules of the Mid-Contract Management recently added to the CRP program.

INTRODUCTION

Henslow's Sparrow (*Ammodramus henslowii*) is a grassland species of considerable conservation concern endemic to southern and eastern North America (Herkert et al 2002; Reinking 2002). Annual declines of about 7.5% from 1960-2000 (Sauer et al. 2001) and the extirpation of breeding birds from large portions of the historic range have led to the sparrow being listed as a species of "Highest Concern" on the Partners in Flight National Watch List (PIFNWL; http://www.abcbirds.org/pif/pif_watch_list.htm). While the Henslow's Sparrow is not currently listed as federally threatened or endangered, most species on the list are prime candidates for such consideration. The Nebraska Natural Legacy Plan (Schneider et al 2005) considers the Henslow's Sparrow a "Tier I At-Risk Species".

The decline in numbers of Henslow's Sparrows in North America (Sauer et al 2001) is generally considered due to reduction in the extent of its preferred breeding habitat, "relatively large fields consisting of tall, dense grass, a well-developed litter layer, standing dead vegetation, and sparse or no woody vegetation." (Herkert et al 2002). Since 1985, however, the Conservation Reserve Program (CRP) has allowed payments to landowners by the United States Department of Agriculture (USDA) through the Farm Service Agency (FSA) to idle croplands and seed them to various grasses. This has provided habitat that appears to have stabilized Henslow's Sparrow numbers in some parts of the breeding range (Herkert 1997; Herkert et al 2002; Reinking 2002; McCoy 2000). CRP grasslands have been shown to be beneficial to non-game grassland songbirds (Johnson and Schwartz 1993; Patterson and Best 1996, Herkert 1998). Nebraska has 472,000 ha. of CRP grassland, about four times more than the remaining area of tallgrass prairie (Steinauer and Collins 1996), but most is ageing, which, without management, reduces its attractiveness to most grassland birds (Negus 2005). Many of these older CRP grasslands have become monocultures of European Smooth Brome (*Bromus inermis*) (Negus 2005).

Henslow's Sparrow is a rare but regular summer resident and breeder in southeast Nebraska (Sharpe et al 2001). In the United States, the breeding range has apparently expanded northwestward in the last two decades (Herkert et al. 2002; Reinking 2002). Nebraska reports were few prior to 1990 and none were reported in the Nebraska Breeding Bird Atlas project 1984-89 (Mollhoff 2001). A set of eggs and a female were said to have been collected in Douglas County prior to 1900 (Bruner et al 1904), and there are 3 specimens in the University of Nebraska State Museum, all collected near Lincoln 26 Apr-18 May 1899-1920 (Sharpe et al 2001). The only other published report prior to 1980 was of a singing male at Nine-Mile Prairie, Lancaster Co, 8 Jul 1951; no others were seen and no nesting evidence was found (Baumgarten 1953).

Since the mid-1980s, however, Henslow's Sparrows have been found in small numbers at several locations in southeastern Nebraska, notably Burchard Lake WMA, Pawnee County; Spring Creek Prairie, Lancaster County; Boyer Chute NWR, Washington County; central Platte Valley sites, Stanton County CRP tracts (Negus 2005), and Pawnee Prairie WMA, Pawnee County (Figure 1). Whether these recent

records indicate an increase in numbers and range of Henslow's Sparrows in Nebraska or reflect observers' searching for them remains unknown, although, as noted above, this species may indeed be expanding its range.

Wright (Wright 1985) first found a singing male on the south side of Burchard Lake in Pawnee County 6 May 1985; this bird was photographed and seen by others through 31 May (Sharpe et al 2001). Since 1985, Henslow's Sparrows have been reported from the Burchard Lake area, both within the Wildlife Management Area (WMA) and on adjacent privately-owned land (Sullivan 2005); Sullivan found 27 singing birds on and around Burchard Lake WMA as well as a nest with 4 eggs on adjacent private land (Sullivan 2005).

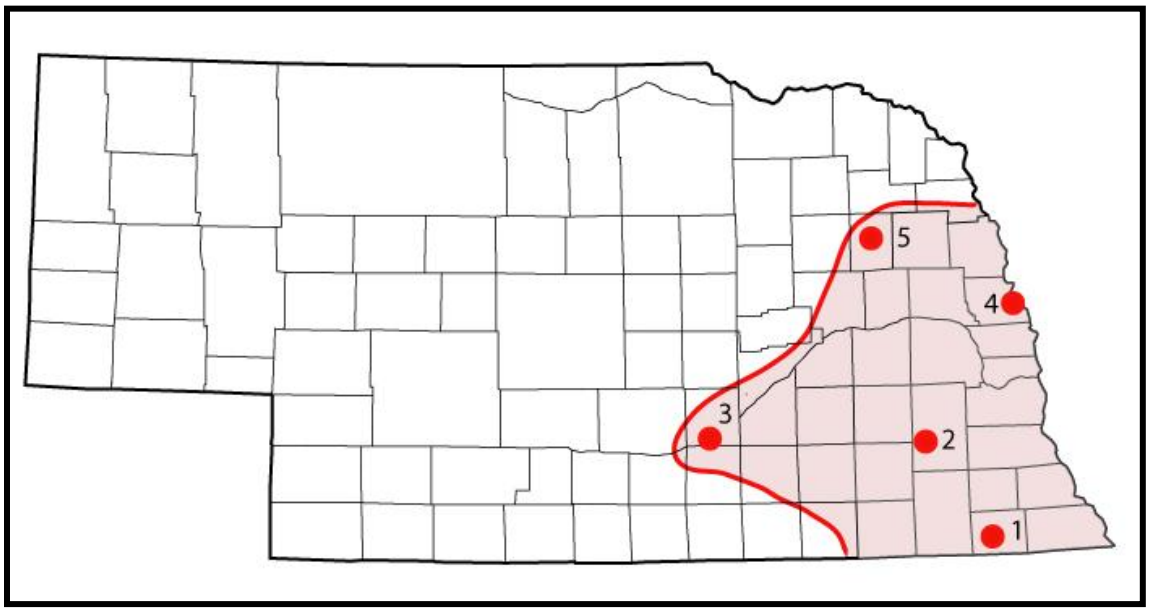

Figure 1. Current breeding distribution of the Henslow's Sparrow in Nebraska. Shaded areas right (east) of red line represent overall range. Red dots are sites where Henslow's Sparrow has occurred with some regularity since 1990, including 1) Burchard Lake-Pawnee Prairie area, Pawnee County, 2) Audubon's Spring Creek Prairie, 3) Whooping Crane Trust properties, Hall County, 4) Boyer Chute National Wildlife Refuge, Washington County, and 5) Stanton County CRP tracts (Negus 2005).

In Lancaster County, a singing Henslow's Sparrow was found in 1994 at Spring Creek Prairie, a Wachiska Audubon Society-owned site near Denton. Since then, a few Henslow's Sparrows have been found there most years, although no breeding activity has been reported. Searches by Concordia University professor Joseph Gubanyi and students from 1994-2000 yielded reports from near Bennet in Lancaster County 25 May 1994, at Meadowlark Lake WMA, Seward Co, each year (maximum 2 singing birds) 1997-2000, and at Redtail WMA, Butler County, 24 June 2000 (Sharpe et al 2001).

Beginning in 2000, singing birds have been found by Jerry Toll in prairie under restoration at Boyer Chute National Wildlife Refuge. Just to the south in Douglas County, 1-2 Henslow's Sparrows have been found at the University of Nebraska at

Omaha's 65 hectare Allwine Prairie Preserve in northwest Omaha in 2004 and 2005 (John P. McCarty and L. LaReesa Wolfenbarger, pers. comm.).

Sullivan (2005) found 8 singing birds in the southwest part of Pawnee Prairie WMA and 2 on adjacent private land in 2004. A nest was found at Pawnee Prairie also (Sullivan 2005).

Furthest west are records of breeding birds on property owned by the Platte River Whooping Crane Maintenance Trust in the central Platte River Valley; native grasslands are being restored and managed by grazing and burning at various sites, with grassland bird species monitored by Avian Ecologist Daniel Kim. In 2006, singing birds were present in May and dependent juveniles were seen later in the summer; numbers of singing birds increased through August (Dan Kim, pers. comm.). There are only 4 records for the Rainwater Basin, all in June and July from Clay County, the first in 1999 (J. Jorgensen, personal observation).

In order to better understand the occurrence of Henslow's Sparrow in Nebraska, a survey of grasslands south and east of Lincoln, Nebraska was undertaken May-August 2006. The goals of this survey included a search for grassland sites that might provide suitable summering habitat, a closer look at any such locations, counting Henslow's Sparrows that might be present, and, if numbers of sparrows allowed, using point transects and distance sampling (Buckland et al. 2001) to determine distribution and density of Henslow's Sparrows (and other species using the same habitat as Henslow's Sparrows).

METHODS

Location of potential Henslow's Sparrow habitat

The study area essentially covered southeast Nebraska south and east of Lincoln, and included all of Otoe, Johnson, Nemaha, Pawnee, and Richardson Counties, and the eastern edges of Lancaster and Gage Counties (Figure 2). This area contains a large number of non-contiguous grasslands of varying quality. The largest tallgrass prairie tract in the study area contains some 1400 hectares on and around Burchard Lake WMA, but is of "fairly low quality", with "very low forb diversity" and "common to abundant cool season grasses" (Steinauer 2003). Data Layers representing grassland tracts greater than 20 hectares in the study area were provided by Andy Bishop (U.S. Fish and Wildlife Service, Grand Island). In addition, maps of CRP-Managed Access Program (CRP-MAP) areas for each county were used to locate grassland tracts.

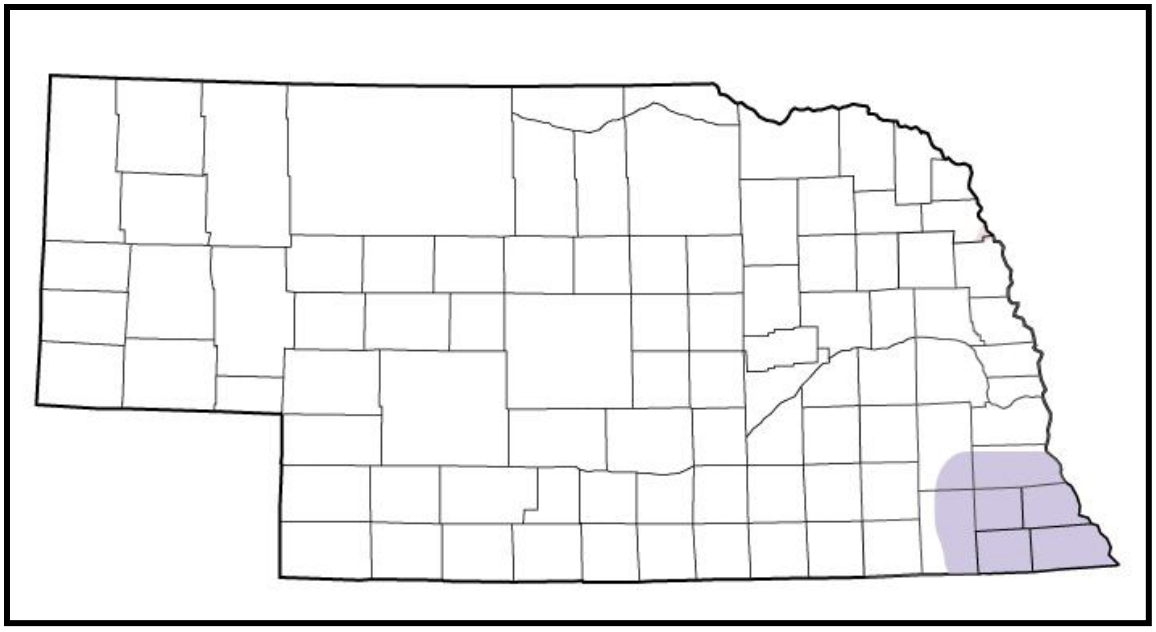

Figure 2. 2006 study area (shaded) in southeast Nebraska.

From the sources mentioned, a master list of grasslands to be investigated was constructed, containing 279 locations (Appendix 1). Locations were evaluated initially by driving to the sites and examining them from the road. Many sites were judged unsuitable simply by noting the absence of standing dead material (dead grasses from previous summers), a key breeding habitat requirement of Henslow's Sparrow. In most cases such grasslands were grazed, hayed, or burned during the previous summer or early spring just prior to the evaluation. Additional sites were eliminated because of a lack of dead litter covering the ground, another requirement. Sometimes this could be determined by roadside inspection, but in many cases a walk-in inspection was needed and was done later in the summer after landowner permission had been obtained. Locations were also eliminated if they had encroachment of woody plants such as Eastern Red-Cedars (*Juniperous virginiana*), small trees such as Green Ash (*Oleaceae fraxinus*), or dense stands of weeds. Finally, locations with dense homogeneous stands of standing dead European Smooth Brome were also judged unsuitable.

This winnowing process identified 63 sites that appeared to have suitable habitat for Henslow's Sparrows. After obtaining permission from landowners, most of these 63 sites were checked on foot. Within each site, all parts of the site that had potentially suitable habitat were searched carefully for Henslow's Sparrows. During this process, the list of 63 sites was reduced to 49, usually because of minimal or absent ground litter cover or high content of clover or alfalfa, features not readily visible from the earlier roadside evaluations, but a few were not checked in the absence of landowner permission. The final 49 sites are listed in Appendix 1, and were distributed among the counties as follows: 2 in Otoe, 1 in Lancaster, 8 in Gage, 13 in Johnson, 17 in Pawnee, 8 in Richardson, and none in Nemaha.

Clearly, this winnowing process depends heavily on the judgment of the observer (WRS) regarding Henslow's Sparrow habitat, and thus introduces bias into the results.

This search was designed as a pilot to obtain baseline information regarding Henslow's Sparrow numbers and distribution; resources were not available for a complete search of every site. However several point transects were run on selected sites that did not have Henslow's Sparrows (see below), and it would seem unlikely that any sparrows would occupy unselected sites with habitat of lesser quality than that existing in selected sites.

Data collection

Two types of data were collected: 1) simple counts of Henslow's Sparrows found at each location during walk-in inspections, and 2) data derived from point transects using distance sampling (Buckland et al. 2001, 2004). Walk-in inspections involved searching the entire site for areas of suitable habitat for singing birds and observing behavior of any birds found. Wherever Henslow's Sparrows were found, the location was recorded using a handheld Global Positioning System (GPS) and the area around the birds was checked for extent of occupation and simple counts of singing Henslow's Sparrows as well as other species present in the grasslands were made. In July and August, sites with Henslow's Sparrows as well as additional sites without sparrows were selected randomly from the list of 49 sites and were checked using distance sampling (Buckland et al. 2001, 2004) at point transects (Reynolds et al. 1980). These transects were conducted at least twice during the breeding season, ending in mid-August. All species encountered on point transects were recorded, and, to limit problems with observer bias, WRS conducted all surveys.

Point transects were laid out systematically along straight lines within each grassland tract. Points were located at least 90 meters from field perimeters along a grid and points were placed along gridlines every 180 meters.

I spent four minutes at each point and recorded all birds and distances from the point. Distances were routinely verified by stepping off and by comparison with GPS distances. Point Transects were run regardless of time of day, as the grassland species under consideration, in particular Sedge Wren (*Cistothorus platensis*), Henslow's Sparrow, Grasshopper Sparrow (*Ammodramus savannarum*), and Dickcissel (*Spiza americana*), are known to sing with some consistency throughout the day and even at night (Herkert et al. 2001; Herkert et al. 2002; Vickery 1996; Temple 2002). Transects were not run, however, if wind was generally above about 25 km per hour, or the temperature rose above 29° Celsius (85° Fahrenheit).

Data from surveys were pooled for analysis. A minimum number of detections (60-80, Buckland et al. 2001) were recorded for three species (Sedge Wren, Grasshopper Sparrow, and Dickcissel) to estimate density using Program DISTANCE 4.1 (Thomas et al. 2004). Program DISTANCE estimates density by fitting observer detection as a function of distance to a set of models. The six candidate models suggested by Buckland et al. (2001, p. 42-50) were used to analyze the data. The largest 10% of distances were truncated to limit possible errors due to outliers (Buckland et al. 2001). Akaike's Information Criterion (AIC) was used to determine relative fit of model. The model with the lowest AIC value was selected and Goodness-of-fit tests were used to support model selection decisions.

RESULTS

Grassland Tract Selection

Appendix 1 lists 279 grassland sites that were investigated for potential Henslow's Sparrow breeding habitat. Of these, 63 were selected, but 14 were later eliminated upon closer inspection, leaving 49 sites to be searched for Henslow's Sparrows. Figure 3 shows the study area.

Sites with Henslow's Sparrows

Only 2 of 279 grassland sites (less than 1%) had Henslow's Sparrows by mid-August that could be presumed to have bred. Henslow's Sparrows were found at only 5 sites in all, and of these sites, 2 had Henslow's Sparrows only in the spring, heavy grazing eliminated the sparrows at another, and by August only 2 sites still held Henslow's Sparrows. Table 1 shows a total count of 45 birds observed at the 5 sites; 18 of these were found on point transects and the remainder were found while the observer was walking between points or during searches conducted in May and June.

Sites 7 and 13, located 5 miles north and 2 miles west of Tecumseh and 5.5 miles south and 5 miles west of Tecumseh respectively, had sparrows in late May and early June, but these had gone by mid-July. These birds may have been migrants. Habitat at both sites appeared unchanged in mid-July except for normal growth; due to dry conditions in the study area, growth was minimal, however. Site 7 was hayed sometime after mid-July and before mid-August, but, as already noted, the sparrows had probably departed prior to haying.

Site 38, Pawnee Prairie WMA, also had sparrows in early June and 2 were still present July 9 at the same places as in early June; a complete search was not done July 9, however, as aggressive bulls were in the area. A large number of cattle were present by mid-July, when the unburned south part of the WMA containing the sparrows was grazed and trampled. No Henslow's Sparrows were present 16 Jul, presumably as their habitat had been destroyed.

Table 1. Counts of Henslow's Sparrows at 5 sites 29 May-13 August 2006.

County	Site	29 May	2-3 June	16 & 22 July	13 Aug	Max count
Johnson	7	8	5	0	0	8
Johnson	13	X	9	0	X	9
Pawnee	10	X	X	4	11	11
Pawnee	23	X	2	4	10	10
Pawnee	38	X	7	0	0	7
					Total	45

X = no count

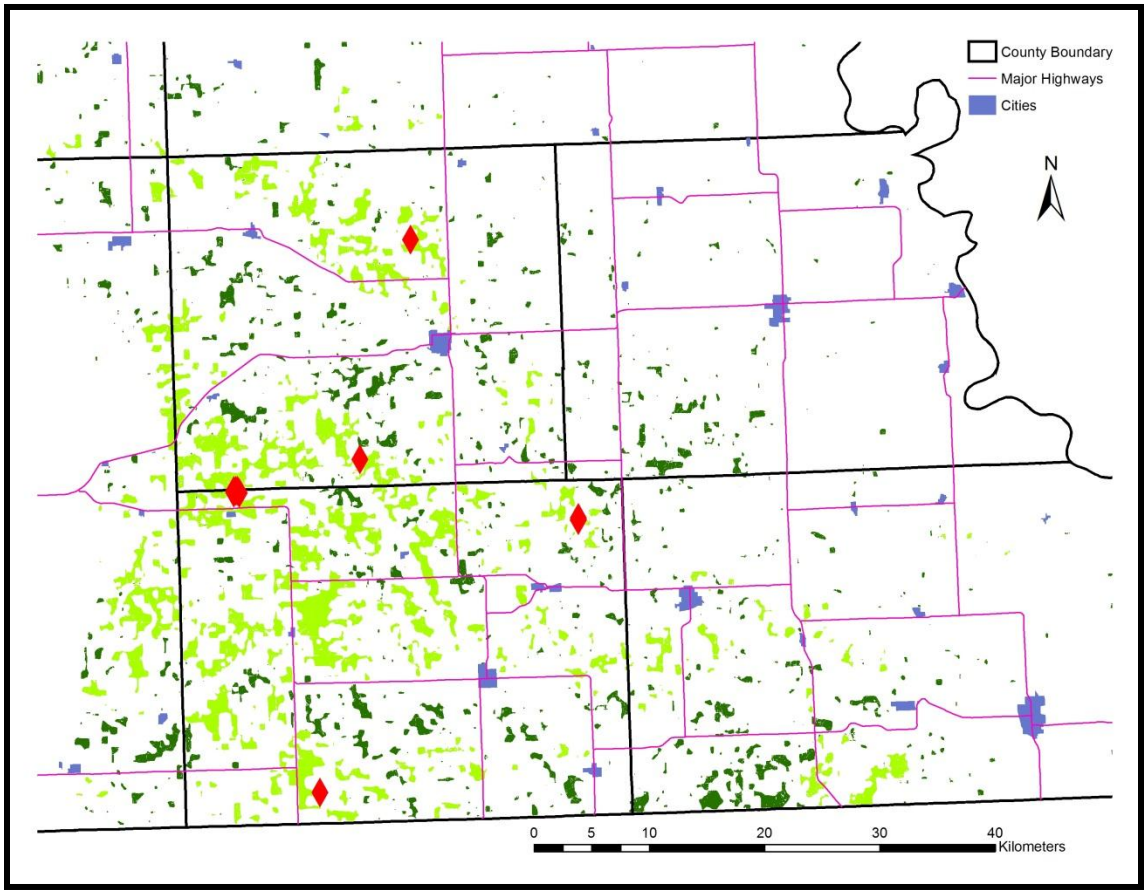

Figure 3. Grassland tracts >20 hectares in southeast Nebraska in green; visited tracts are in light green, red diamonds indicate sites where Henslow's Sparrows were found in 2006.

Sites 10 and 23, located 4 miles north and one mile east of the east edge of Table Rock and 5.5 miles south and one mile east of Crab Orchard respectively, had sparrows from early June through mid-August (Site 10 was not checked in early June). Interestingly, numbers of sparrows increased at both sites, with mid-August counts of 11 at Site 10 and 10 at Site 23. These were all singing males, and thus the increase was not attributable to the presence of juveniles. At both sites, the areas occupied in mid-July were expanded in mid-August, rather than new areas within the overall site being established. Similar increases in late summer have been observed previously at major sites in Kansas (Zimmerman 1993) and Oklahoma (Reinking et al. 2000), and are possibly examples of conspecific attraction (Ahlering and Faaborg 2006), a phenomenon previously noted in Baird's Sparrow (Ahlering 2005) and other grassland birds (Green et al. 2002).

Interestingly, all Henslow's Sparrows found in this study were at or near high points at the various sites; none were found in draws. This finding is similar to that of Negus (2005), who found Henslow's Sparrows on hilltops where vegetation was less dense than in valleys.

Other Species

Apart from Henslow's Sparrow, the surveys found that Sedge Wren, Grasshopper Sparrow, and Dickcissel were the most numerous grassland species encountered. Other grassland species of conservation concern, such as Eastern Meadowlark (*Sturnella magna*), Upland Sandpiper (*Bartramia longicauda)*, and Loggerhead Shrike (*Lanus ludovicianus*) were encountered infrequently or rarely. Common Yellowthroat (*Geothlypis trichas*) was found regularly, but was not widespread. Sedge Wrens were absent until 9 July, when a few were noted, but by 16 July, numbers had increased dramatically, with essentially all sites investigated found to be occupied. Grasshopper Sparrows were present and singing throughout the study, with several juveniles observed from early July on. Dickcissels were common through the study until 13 Aug, when only one was found. Several Dickcissel nests were located, many containing Brown-headed Cowbird (*Molothrus ater*) eggs.

A comparison of the most numerous species present when Henslow's Sparrows are present versus when they are absent is of interest. Table 2 summarizes these data, and shows that Grasshopper Sparrow is most strongly associated with presence of Henslow's Sparrow, followed by Sedge Wren. Dickcissel, however was associated negatively with presence of Henslow's Sparrow. This is not surprising, as Dickcissel prefers more woody encroachment and coarser vegetation for use as singing perches (Temple 2002) than is tolerated by Henslow's Sparrow (Herkert et al. 2002).

Table 2. Most numerous species (percentage of total birds present) when Henslow's Sparrow present or absent

	Present	Absent	Difference
Sedge Wren	26	17	9
Dickcissel	24	31	(7)
Grasshopper Sparrow	22	9	13
Henslow's Sparrow	7	0	
Eastern Kingbird	7	3	4

Density Analysis for Associated Species

Henslow's Sparrows detections were too few to estimate density, but density estimates were made for the three most frequently encountered species: Dickcissel, Sedge Wren and Grasshopper Sparrow (Table 3). Density estimates, however, are not representative of all grasslands found in the study area but only those selected as potentially having Henslow's Sparrows. Each of the three species, but especially Sedge Wren and Grasshopper Sparrow, have been observed to occur commonly in or near habitat occupied by Henslow's Sparrow (Melde and Koford 1996; Sullivan 2005).

Table 3. Density and associated parameters (± SE) for Dickcissel, Grasshopper Sparrow, and Sedge Wren in selected grassland tracts in southeast Nebraska.

	Dickcissel	Grasshopper Sparrow	Sedge Wren
Birds detected	144	75	103
Density (birds/per ha.)	1.98 (±0.32)	1.75 (±0.27)	2.37 (±0.37)
Detection probability	0.58 (±0.08)	0.08 (±0.01)	0.74 (±0.05)
Effective radii (m)	55.69 (±3.75)	35.83 (±1.54)	35.52 (±1.08)

For each species, hazard rate with cosine and hazard rate with simple polynomial registered the lowest AIC values (Tables 4-6). The other four models had ΔAIC > 1.0. Variation in ΔAIC was greater for Grasshopper sparrow than the other two species. Furthermore, goodness-of-fit tests ($P < 0.10$) indicated poor model fit. Over 86% (n=75) of Grasshopper Sparrow detections were between 18-37 meters and only 3 detections were beyond 37 meters. Poor model fit is perhaps related to movement of sparrows away from the observer and difficulty detecting sparrow at distances > than 37 meter perhaps which resulted in a clumping of data. A principal assumption of distance sampling is that objects are detected at their original locations (Buckland et al. 2001). How grassland bird movement is influenced by human presence is not known, but it would seem logical that birds do avoid humans and this may have biased estimates. On the other hand, detection bias may be species specific. It has been suggested that Henslow's Sparrows may be induced to sing as an observer walks through their territories (Melde and Koford 1996) and Sedge Wren may be attracted towards observers (pers. obs.).

Table 4. Individual results for the six models used to estimate Dickcissel

Model	Δ AIC	AIC	Density (birds/hectare)	CV
Hazard rate + cosine	-	1216.55	1.97	0.16
Hazard rate + simple polynomial	-	1216.55	1.97	0.16
Uniform + simple polynomial	4.50	1221.05	1.95	0.10
Half normal + hermite polynomial	3.17	1219.72	2.00	0.32
Half normal + cosine	3.04	1219.59	2.09	0.36
Uniform + cosine	1.65	1218.20	2.07	0.29

Table 5. Individual results for the six models used to estimate Sedge Wren density.

Model	Δ AIC	AIC	Density (birds/hectare)	CV
Hazard rate + cosine	-	737.37	2.37	0.154
Hazard rate + simple polynomial	-	737.37	2.37	0.154
Uniform + simple polynomial	4.06	741.43	2.45	0.280
Half normal + hermite polynomial	6.03	743.40	2.55	0.156
Half normal + cosine	5.39	742.76	2.90	0.791
Uniform + cosine	3.79	741.45	2.84	0.655

Table 6. Individual results for the six models used to estimate Grasshopper Sparrow density.

Model	Δ AIC	AIC	Density (birds/hectare)	CV
Hazard rate + cosine	-	588.05	1.76	0.161
Hazard rate + simple polynomial	-	588.05	1.76	0.161
Uniform + simple polynomial	28.14	616.19	2.16	0.253
Half normal + hermite polynomial	39.17	627.22	2.44	0.149
Half normal + cosine	17.16	605.21	2.01	0.211
Uniform + cosine	171.94	759.99	0.35	0.137

DISCUSSION

Henslow's Sparrows were found at only five sites out of a total of 279 that totaled approximately 29,500 ha. While some Henslow's Sparrows were certainly not detected because of survey limitations, it is apparent that the species is neither common nor widespread in southeast Nebraska. The relatively small number of fields possessing suitable habitat is likely the primary factor limiting the number of Henslow's Sparrows in this region. Improvement of conservation lands for Henslow's Sparrow will likely benefit an entire suite of grassland birds.

Although habitat preferences of Henslow's Sparrow are well-known (Herkert et al. 2002), there are two major problems in determining management of grasslands in order to enhance numbers of breeding birds, especially in Nebraska, where most grasslands are privately-owned. These are (1) low site fidelity, and (2) the disjunction of the usually-practiced annual grassland management procedures with the longer-term changes necessary for development of suitable habitat.

In many cases involving preservation or management of habitat for certain bird species, the target bird species return each year to the same site. This is generally not true for grassland birds, most notably Henslow's Sparrow (Herkert et al, 2002; Reinking et al.2000). Thus there is no guarantee that effort and expense spent maintaining what might appear to be suitable breeding habitat will be rewarded if the birds do not return.

Of interest in this respect were experiments carried out with Baird's Sparrows in North Dakota (Ahlering 2005). Because of strong conspecific attraction in grassland sparrows, some sites are abandoned as birds gravitate to areas occupied by experienced birds that continue to sing and thus attract conspecifics well into the breeding season. This effect may have occurred in this study as well. Ahlering (2005) found that Baird's Sparrows could be attracted to areas of suitable but unoccupied habitat by playing taped songs. These taped songs attracted birds that then bred successfully. Because only a small percentage of Nebraska grasslands are in public hands and presumably more amenable to management for Henslow's Sparrows, this technique might allow the use of fewer sites or possibly smaller areas of managed grassland to maintain or enhance existing numbers of Henslow's Sparrows.

Of course, the technique described above is still dependent on existence of suitable habitat, albeit somewhat less of it. Grassland management techniques for Henslow's Sparrow are well-known and may be summarized as follows (extracted from Herkert 1998, revised 2002):

(1) provide at least 25 hectares of contiguous grassland, more if not within a grasslands landscape,
(2) avoid disturbance (burning, mowing) on an annual basis,
(3) leave occupied grasslands undisturbed 15 April-15 September,
(4) provide dense and tall (>5 feet) grassy vegetation,
(5) remove woody vegetation taller than the grassy vegetation,
(6) native grasses and forbs should comprise at least part of the vegetation mix.

Most grassland managers achieve these objectives using interseeding of desired species and prescribed burning on a rotating basis. A grassland should be divided into at least three equal areas, one burned each year. This allows at least two years of undisturbed growth, which provides sufficient standing dead stalks and ground litter to attract Henslow's Sparrows, as well as limiting encroachment of woody vegetation. The management techniques listed above suggest at least 25 hectares of contiguous grassland is required for Henslow's Sparrow use, but the exact figure is not well-characterized (Herkert 1998, revised 2002). If rotational burning is used, it would be advisable to use a total minimum area of about 80 hectares, divided into 3 parts, each of 25 hectares, to meet the minimum suggested.

Since about 1985, the setting-aside of significant areas of poorer-quality cropland and seeding them to grassland in the Federal (USDA) CRP program has provided an opportunity to provide more habitat for Henslow's Sparrow. Initially, fields in the program were seeded to homogeneous stands of European Smooth Brome combined with various legumes (Negus 2005); such fields, if unmodified, are not attractive to Henslow's Sparrows. Indeed, of over 45,000 hectares of CRP grassland enrolled in Gage, Johnson, and Pawnee Counties 1986-1993, more than 80% was planted to European Smooth Brome (Taylor 2000). This increase of brome grassland has possibly resulted in increases of Greater Prairie-Chicken (*Tympanuchus cupido*) (Taylor 2000), but has likely

had limited benefit for the Henslow's Sparrows, other grassland birds, and other native organisms.

Another important modification of the CRP rules involved generous incentive payments for "mid-contract management", which encouraged mowing, grazing, burning, or disking/ interseeding to promote habitat diversity (Negus 2005). These practices must be used at least once during the CRP contract, but only on a maximum of one-third of a field in any one year (Negus 2005). Interseeding CRP fields with native species as part of mid-contract management seems to have improved attractiveness of CRP grasslands to Henslow's Sparrows. This study has shown that numbers of Henslow's Sparrows will utilize such fields. Indeed, in this study the only two sites (sites 10 and 23 in Table 1) with Henslow's Sparrows by mid-August were CRP grasslands with significant native grass species present.

Although most remaining tallgrass prairie in Nebraska is in private hands and managed for grazing or haying, and is generally not attractive to Henslow's Sparrows. Sullivan (2005) studied the use of such prairies by grassland birds in Pawnee County and the Denton Hills, just southwest of Lincoln, the latter area including Spring Creek Prairie. Prairies were ranked according to their natural purity, the highest ranking assigned to those with little exotic invasion, highest diversity, and high-quality forbs. Henslow's Sparrows were found at three locations, and at private grasslands adjacent to them, Burchard Lake WMA, Pawnee Prairie WMA, and Spring Creek Prairie. Analysis of vegetation at these sites and comparison with sites that did not have Henslow's Sparrows showed Henslow's Sparrows preferred sites with greater litter depth (t_{42} = 5.12, $P<0.01$) and standing residue (t_{42} = 1.85, $P< 0.07$). This comports with previously published information (Herkert et al. 2002).

Table 7. Comparison of averages of vegetation characteristics at sites with Henslow's Sparrows on public lands and adjacent private lands.

Parameter	Private (n=2)	Public (n=7)
visible obstruction	388.0	512.8
max height	367.0	367.4
litter depth	51.5	95
bare ground	42.5	6.6
standing dead residue	56.5	71.4

Analysis of Sullivan's data shows no significant differences between Henslow's Sparrow habitat on public lands and that on adjacent private lands (Table 7), although it was noted by Sullivan that Henslow's Sparrows found on private grassland adjacent to the west side of Burchard Lake NWR occupied pasture with "abundant grass and forb cover", suggesting that the grasslands studied were generally lightly-grazed.

FUTURE OUTLOOK

According to Partners in Flight, priorities and objectives for grassland birds in Nebraska include doubling the statewide population of Henslow's Sparrow, although the same publication notes that current population numbers are unavailable (Rosenberg 2004). The concept of Partners in Flight population objectives relative to Henslow's Sparrow in Nebraska is questionable. This study found 45 singing male Henslow's Sparrows at five sites, after searching at most one quarter of the likely summer range in Nebraska. While there is as yet no firm basis for estimating the number of Henslow's Sparrows summering in Nebraska, an informed guess would be that there are fewer than a few hundred individuals, including an unknown number of breeding birds.

In order to increase the breeding numbers, we believe that the best approach is to re-establish large blocks of native prairie communities. A secondary approach is to increase interseeding CRP grasslands with native grassland species and to formulate protocols for rotational disturbance such as burning and/or haying and grazing of such grasslands. Some form of disturbance is necessary to maintain prime habitat for Henslow's Sparrow, and such disturbance, traditionally lightning- and human-caused fire (Steinauer and Collins 1996, Reinking 2005) and patchy heavy grazing by bison, can be replicated using rotations of grazing, burning, haying, or combinations of these. The mid-contract management program recently installed for CRP grasslands by USDA (Negus 2005) should result in increased use of these practices, provided adequate financial incentives remain in place.

As might be expected, private owners of grasslands manage them for profit, in Nebraska usually cow-calf operations involving extensive grazing. This use essentially eliminates any old growth from previous years as well as ground litter, rendering grazed grasslands unsuitable for Henslow's Sparrow (Zimmerman 1997). In conjunction with grazing, well-managed grasslands usually are burned in order to control encroachment of woody vegetation. Some grasslands are mowed, although this is a small percentage of the total. Incentives similar to those in the mid-contract management program could be provided for private owners to follow similar disturbance practices on grasslands currently too heavily grazed to be attractive to Henslow's Sparrow; studies in Missouri have shown that Henslow's Sparrows will use lightly-grazed (>30.4 cm vegetation height) pastures (Skinner 1975). Such incentives, however, would have to be large enough to replace projected profit levels from traditional grazing practices. In addition, Henslow's Sparrows might be attracted to unoccupied sites by using taped songs in July as discussed above.

Rotational disturbance practices should also be used on publicly owned sites, particularly those where Henslow's Sparrows have been found previously, such as Burchard Lake WMA and Pawnee Prairie WMA in the study area, and Spring Creek Prairie near Denton, among others. The minimum area required could be as little as 80 hectares divided into 3 segments of about 25 hectares, one burned each year. Ideally, an entire site could be divided into 3 or 4 segments. Mowing and grazing should be avoided on areas set aside for Henslow's Sparrows.

With consideration of a new Farm Bill in 2007, the Agricultural Policy Analysis Center at the University of Tennessee (De La Torre Ugarte and Hellwinckel 2006) evaluated the effects of disassembly of the CRP and concluded that "If either federal farm legislation or federal budget priorities eliminates the CRP as the contracts expire, … an estimated 37% of today's 34.7 million CRP acres, or 12.6 million acres, will return to crop production by 2015." Economic considerations such as net cost to the Federal Government, however, favor continuation of the CRP program (De La Torre Ugarte and Hellwinckel 2006).

ACKNOWLEDGEMENT

We would like to thank Andy Bishop for providing useful GIS data that were used for this survey.

LITERATURE CITED

Ahlering, M.A. 2005. Settlement Cues and Resource Use by Grasshopper Sparrows and Baird's Sparrows in the Upper Great Plains. Ph.D. dissertation, University of Missouri, Columbia.

Ahlering, M.A., and J. Faaborg. 2006. Avian Habitat Management Meets Conspecific Attraction: If You Build It, Will They Come? Auk 123: 301-312.

Baumgarten, H.E. 1953. Henslow's Sparrow at Lincoln. Nebr. Bird Review 21: 25.

Bruner, L., R.H. Wolcott, and M.H. Swenk. 1904. A Preliminary Review of the Birds of Nebraska, with Synopses. Klopp and Bartlett, Omaha.

Buckland, S.T., D.R. Anderson, K.P. Burnham, J.L. Laake, D.L. Borchers and L. Thomas. 2001. *Distance Sampling: Estimating Abundance of Biological Populations*. Oxford and New York: Oxford University Press, 432 pgs.

Buckland, S.T., D.R. Anderson, K.P. Burnham, J.L. Laake, D.L. Borchers and L. Thomas. 2004. Advanced Distance Sampling: Estimating Abundance of Biological Populations. Oxford and New York: Oxford University Press.

De La Torre Ugarte, D., and C. Hellwinckel. 2006. Analysis of the Economic Impacts on the Agricultural Sector on the Elimination of the Conservation Reserve Program. Agricultural Policy Analysis Center, University of Tennessee, Knoxville.

Green, M. T., P. E. Lowther, S. L. Jones, S. K. Davis, and B. C. Dale. 2002. Baird's Sparrow (*Ammodramus bairdii*). *In* The Birds of North America, No. 638 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Herkert, J.R. 1997. Population trends of the Henslow's Sparrow in relation to the Conservation Reserve Program in Illinois, 1975-1995. J. Field Ornithol. 68: 235-244.

Herkert, J.R. 1998, revised 2002. Effects of Management Practices on Grassland Birds: Henslow's Sparrow. Northern Prairie Wildlife Research Center, Jamestown, ND.

Herkert, J. R., D. E. Kroodsma, and J. P. Gibbs. 2001. Sedge Wren (*Cistothorus platensis*). *In* The Birds of North America, No. 582 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Herkert, J.R., P.D. Vickery, and D.E. Kroodsma. 2002. Henslow's Sparrow (*Ammodramus henslowii*). In The Birds of North America, No. 672 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Johnson, D.H., and M.D. Schwartz. 1993. The Conservation Reserve Program: Habitat for Grassland Birds. Great Plains Research 3:273-295.

McCoy, T.D. 2000. Effects of Landscape Composition and Multi-scale Habitat Characteristics on the Grassland Bird Community. Ph.D. dissertation, University of Missouri, Columbia.

Melde, P.B., and R.R. Koford. 1996. Henslow's Sparrow Nesting Observations, Habitat Associations, and History in Iowa. Iowa Bird Life 66:117-122.

Mollhoff, W.J. 2001. The Nebraska Breeding Bird Atlas 1984-1989. Nebraska Ornithologists' Union Occ. Papers No. 7. Nebraska Technical Series No. 20. Nebraska Game and Parks Commission, Lincoln.

Negus, L.P. 2005. Grassland Bird Response to Disking/Interseeding of Legumes in Conservation Reserve Program Lands in Northeast Nebraska. M.Sc. Thesis, Oklahoma State University, Stillwater.

Patterson, M.P., and L.B. Best. 1996. Bird Abundance and Nesting Success in Iowa CRP fields: the Importance of Vegetation Structure and Composition. American Midland Naturalist 135: 153-167.

Pruitt, L. 1996. Henslow's Sparrow Status Assessment. U.S. Fish and Wildlife Service. Fort Snelling, MN.

Reinking, D.L. 2002. A Closer Look: Henslow's Sparrow. Birding 34: 146-153.

Reinking, D.L. 2005. Fire Regimes and Avian Responses in the Central Tallgrass Prairie. Studies in Avian Biology 30:116-126.

Reinking, D.L., D.A. Weidenfeld, D.H. Wolfe, and R.W. Rohrbaugh Jr. 2000. Distribution, Habitat Use, and Nesting Success of Henslow's Sparrows in Oklahoma. Prairie Naturalist 32: 219-232.

Reynolds R.T., J.M. Scott, and R.A. Nussbaum. 1980. A variable circular-plot method for estimating bird numbers. The Condor 82: 309-313.

Rosenberg, K.V. 2004. Partners in Flight Continental Priorities and Objectives Defined at the State and Bird Conservation Region Levels. Nebraska. Cornell Lab of Ornithology, Ithaca, NY.

Sauer, J.R., J.E. Hines, and J. Fallon. 2001. The North American Breeding Bird Survey, results and analysis 1966-2000. Version 2001.2. Laurel, MD: Patuxent Wildlife Research Center, U.S. Geological Survey. http://www.mbr-pwrc.usgs.gov/bbs/bbs,html.

Schneider, R., M. Humpert, K. Stoner, and G. Steinauer. 2005. The Nebraska Natural Legacy Project. Nebraska Game and Parks Commission, Lincoln.

Sharpe, R.S., W.R. Silcock, and J.G. Jorgensen. 2001. The Birds of Nebraska, Their Distribution and Temporal Occurrence. University of Nebraska Press, Lincoln.

Skinner, R.M. 1975. Grassland Use Patterns and Prairie Bird Populations in Missouri.

Pages 171-180 in M.K. Wali, ed. Prairie: A Multiple View. University of North Dakota Press, Grand Forks.

Steinauer, R.F. 2003. 2003 Survey for Priority Natural Communities in Nebraska. Final Report. Nebraska Game and Parks Commission, Lincoln.

Steinauer, E.M, and S.L. Collins. 1996. Prairie Ecology- The Tallgrass Prairie. Pages 39-52 in F.B. Samson and F.L. Knopf, eds. Prairie Conservation: Preserving North America's Most Endangered Ecosystem. Island Press, Washington, DC.

Sullivan, S. 2005. Ecological Community Inventory- BCR 22. Summary Report for 2004 Field Season. Nebraska Game and Parks Commission, Lincoln.

Taylor, J.S. 2000. Greater Prairie-Chicken in southeast Nebraska: an overview of population status and management considerations. Nebraska Game and Parks Commission, Lincoln.

Temple, S. A. 2002. Dickcissel (*Spiza americana*). *In* The Birds of North America, No. 703 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Thomas,L., J.L. Laake, S. Strindberg, F.F.C Marques, S.T. Buckland, D.L. Borchers, D..R. Anderson, .K.P. Burnham, S.L. Hedley, J.H. Pollard, and J.R.B. Bishop. 2004. Distance 4.1. Release 2. Research Unit for Wildlife Population Assessment, University of St. Andrews, UK. http://www.ruwpa.st-and.ac.uk/distance/

Vickery, P. D. 1996. Grasshopper Sparrow (*Ammodramus savannarum*). *In* The Birds of North America, No. 239 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

Wright, R. 1985. Henslow's Sparrow. Nebr. Bird Review 53: 43-44.

Zimmerman, J.L. 1993. The Birds of Konza. University Press of Kansas, Lawrence.

Zimmerman, J.L. 1997. Avian Community Responses to Fire, Grazing, and Drought in the Tallgrass Prairie. Pages 167-180 in F.L. Knopf and F.B. Samson, eds. Ecology and Conservation of Great Plains Vertebrates. Springer-Verlag, New York.